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GUEST EDITORIAL

Sleep and the human impacts of climate change

In this issue of Sleep Medicine Reviews, Rifkin and colleagues (referred subsequently as RLP) [1] report on a systematic review of the literature – and present a conceptual framework for – the potential impacts of climate change on human sleep. Their review spans literature from 1980 to 2017 and results in 16 studies matching the authors' selection criteria. Across these studies, RLP report a tendency of exposure to warmer temperatures, extreme weather events, floods, or wildfires to associate with diminished total sleep times as well as incidences of sleep disruption. Given the importance of the topic and the relative sparseness of studies relating to it, we appreciate the effort RLP put into conducting their review. The authors' main takeaway corresponds with our own: the empirical literature linking the physical effects of climate change to alterations in human sleep is highly limited in both scope and quality. More and better research on the topic is needed.

Here we very briefly outline some of the primary human impacts of a changing climate along with a primary limitation of this literature: it lacks clear causal mechanisms. It is a monumental scientific challenge to understand the complex pathways through which the climate influences our well-being. We argue that sleep scientists can – and should – play a vital role in elucidating these causal mechanisms, in turn expanding scientific comprehension of the human impacts of a changing climate.

Climate change is likely to substantially disrupt human systems [2]. From human migration flows [3] to political functioning [4–6], from human physical activity patterns [7] to risk of heat related illness [8,9], from daily moods [10] to mental health [11,12] and from individual productivity [13] to economy-wide growth [14], the impacts of our changing climate touch most domains of our lives. These impacts are not just physical, but acutely social. A burgeoning body of careful empirical work conducted by scholars from across the social and medical sciences has coalesced to support this conclusion [2,15,16].

While work on the human impacts of climate change aids in the conceptual design of policies surrounding both climate change mitigation and adaptation, like all sciences, it is subject to certain methodological limitations. First and foremost, we cannot know the future with certainty, and many social developments might occur to limit the degree to which past empirical relationships, like the relationship between heat and mortality [17], persist into the future. Aside from careful attempts to estimate rates of past adaptation [18], there is not much we as scientists can do to fully ameliorate this limitation. However, another important limitation – the identification of causal mechanisms – presents more of an opportunity, particularly for sleep scientists.

For example, why does temperature impact our emotional states? Why does it impact exercise patterns? Why does heat harm mental health? What causes workers to be less productive at high temperature extremes? Why does cognitive capacity decline with heat [19,20]? Perhaps being in a worsened mood hinders desire to go out and exercise. Or perhaps the relationship is the inverse. Perhaps lowered productivity at work leads to negative interpersonal interactions that in turn worsen longer-run mental health outcomes. Or perhaps it's the opposite. Perhaps lowered cognitive capacity is the result of lower affective states. No one really knows for sure what, exactly, causes what.

Sleep is a factor that theoretically could underlie all of the above results. But, until very recently, the study of sleep had been nearly absent from the empirical climate change literature. Our study [21] as well as that of RJP, has started to bring attention to the potentially critical role sleep may play in understanding the broad-scale impacts of a shifting climate. For example, might lack of sleep the night prior to a test be the reason we observe that hot temperatures hurt test performance [19]? Or, might insufficient rest produce a lowered desire to exercise, in turn worsening the health outcomes associated with inactivity? Obviously each of these factors has the potential for complex and interactive dynamics with the others. But disrupted sleep due to exposure to higher nighttime temperatures, alone, could mediate many of the observed human impacts of temperature.

Causal mediation analysis in this setting is quite difficult [22], but a better understanding of the ways that exposures to ambient temperatures can alter human sleep will only help solidify our comprehension of the role sleep may play in these complex processes. Further, understanding the causal mechanisms for how hotter temperatures produce worsened human outcomes is vital from a policy standpoint. If sleep underlies many of the subsequent problems we observe, we can treat – possibly relatively inexpensively – these downstream problems at their source by diminishing the negative impact of higher temperatures on sleep. If, instead, we attempt to treat the symptoms of worsened sleep, the costs of climate resilience might be markedly higher.

Much work remains. As RJP astutely assert, large-scale studies employing more objective measures of sleep – rather than self report data – are critical. So too are detailed studies outlining potential ways for individuals to improve the resiliency of their sleep to the increased stress posed by higher nighttime temperatures and other weather extremes. We hope that sleep scientists will join the interdisciplinary climate impacts community to perform such vital research in the future. We need your expertise.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.smrv.2018.09.002.

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Nick Obradovich*
Massachusetts Institute of Technology, Media Lab, 77 Mass. Ave., Cambridge, MA, USA

Robyn Migliorini
Edith Nourse Rogers Memorial Veterans Hospital, Psychology Department, Springs Rd. Bedford, MA, USA

* Corresponding author.
E-mail address: nobradov@mit.edu (N. Obradovich).

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